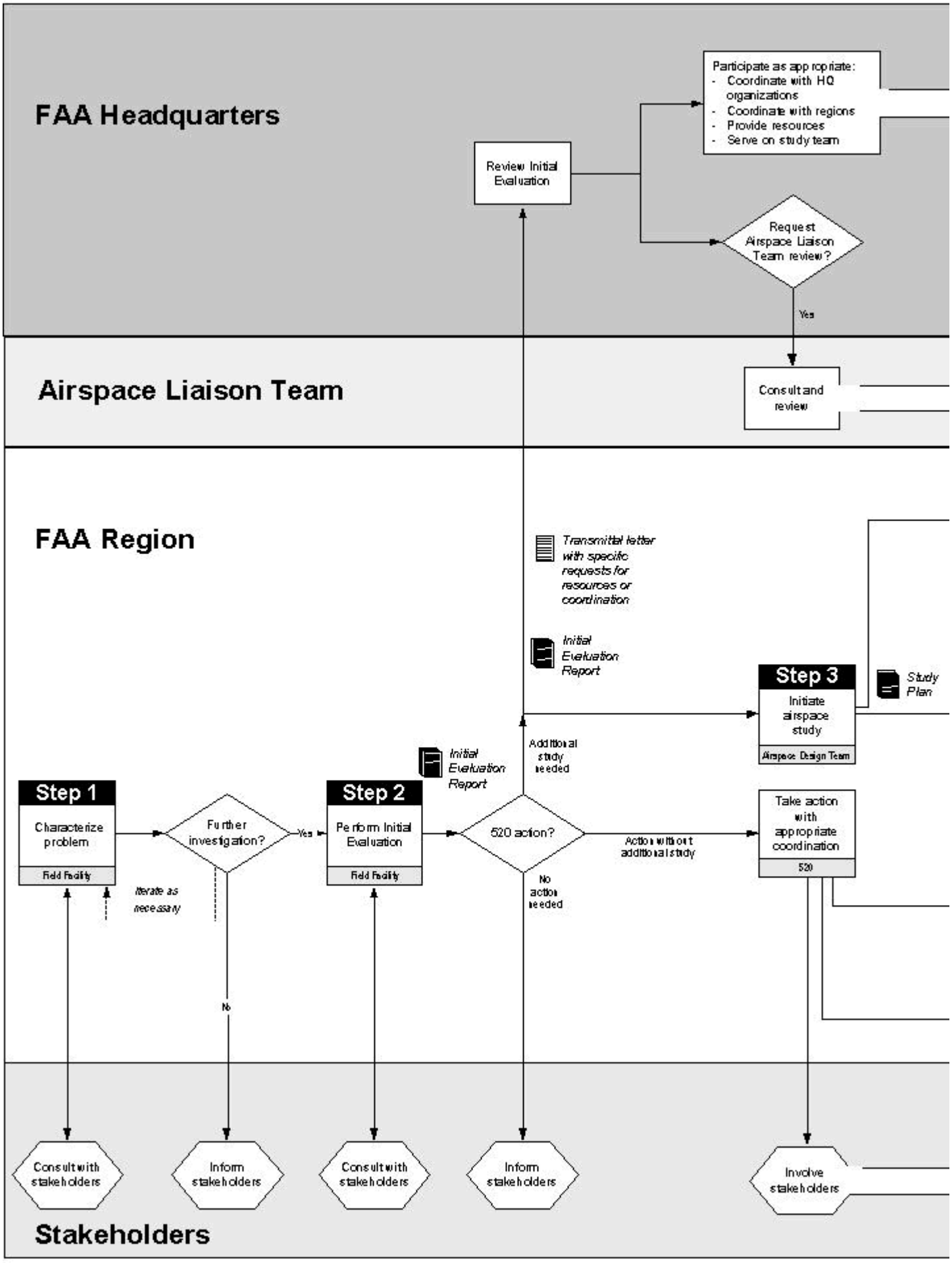
AIRSPACE MANAGEMENT HANDBOOK

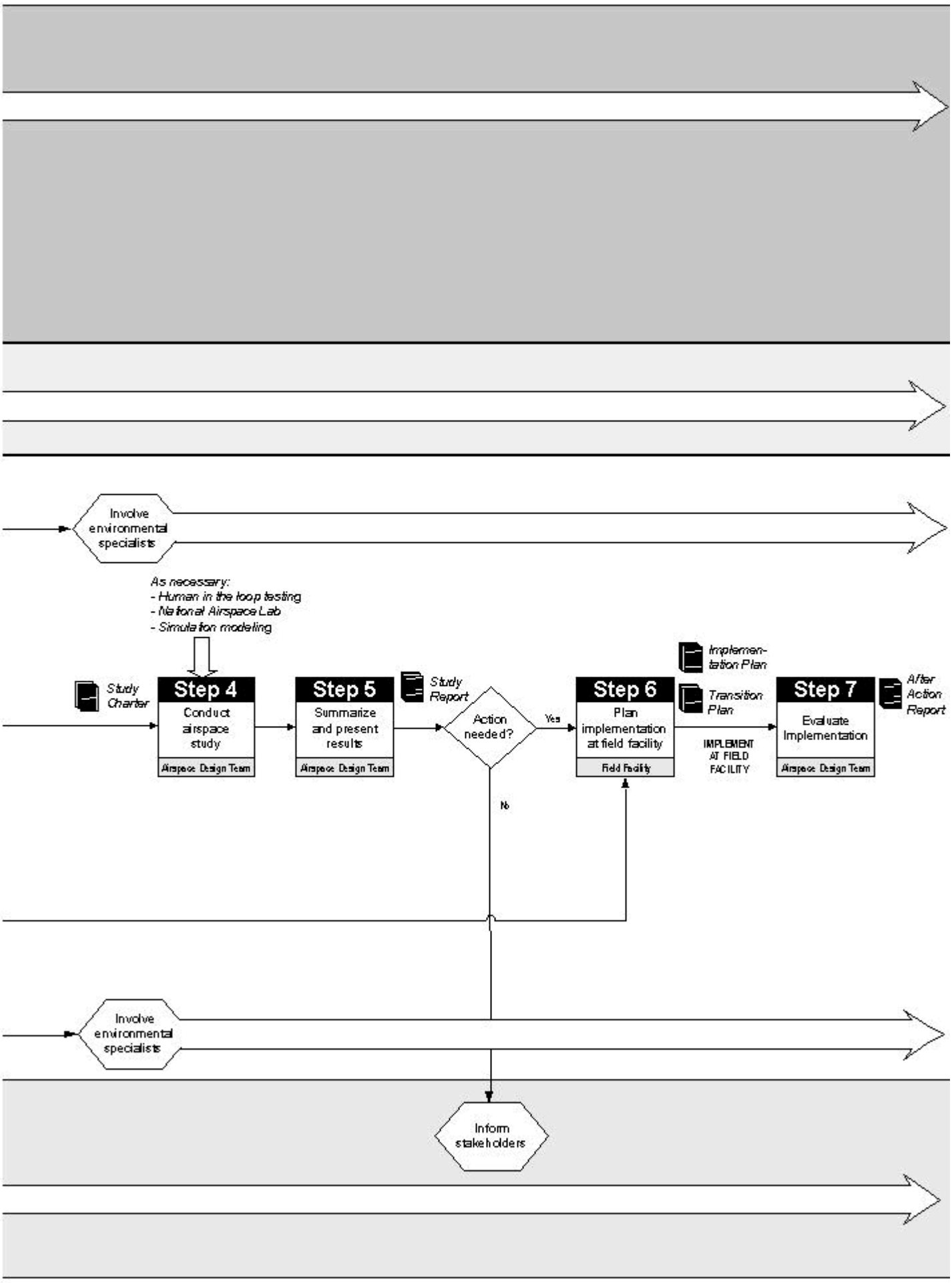
CHECKLIST

The Airspace Management Handbook – consisting of this checklist and the associated guidelines – has been prepared primarily for the specialists in the field who may have to initiate or participate in the process of making changes to the airspace structure. These specialists may be working in the regional offices, an air route traffic control center (ARTCC), a terminal radar approach control (TRACON), or an air traffic control tower (ATCT). This handbook will also be provided to members of the Air Traffic Services (ATS) offices at FAA Headquarters, as well as to the many stakeholders in the aviation community. Stakeholders are those who may be impacted by a change in the airspace structure, including airspace users (i.e., the major air carriers, regional carriers, general aviation, and the military), air traffic service providers (i.e., air traffic controllers, adjacent facilities, airport operators, and the military), and others such as local communities, special interest groups, and federal, state and local agencies.

This checklist includes a two-page pictorial representation of the overall process associated with proposed changes to the airspace structure. Each of the seven-steps identified in the process is further explained and amplified in the guidelines that constitute the main portion of this handbook. Included in the guidelines are references to other, more-detailed documents, that provide even more amplification on some elements of the airspace management process.

Questions or suggestions concerning this handbook should be directed to:
Federal Aviation Administration
Office of Air Traffic Airspace Management
Planning and Analysis Division (ATA-200)
800 Independence Avenue, SW
Washington, DC 20591


FAA Headquarters
Participate as appropriate:
- Coordinate with HQ organizations
- Coordinate with regions
- Provide resources
- Serve on study team
Review Initial Evaluation
Request Airspace Liaison Team review?
Yes
Airspace Liaison Team
Consult and review
FAA Region
Transmittal letter with specific requests for resources or coordination
Initial Evaluation Report
Step 3
Initiate airspace study
Airspace Design Team
Study Plan
Additional study needed
Initial Evaluation Report
Step 1
Characterize problem
Field Facility
Further investigation?
Yes
Step 2
Perform Initial Evaluation
Field Facility
520 action?
Action without additional study
Take action with appropriate coordination
520
Iterate as necessary
No
No action needed
Consult with stakeholders
Inform stakeholders
Consult with stakeholders
Inform stakeholders
Involve stakeholders
Stakeholders


Involve environmental specialists
As necessary:
- Human in the loop testing
- National Airspace Lab
- Simulation modeling
Study Charter
Step 4
Conduct airspace study
Airspace Design Team
Step 5
Summarize and present results
Airspace Design Team
Study Report
Action needed?
Yes
No
Step 6
Plan implementation at field facility
Field Facility
Implementation Plan
Transition Plan
IMPLEMENT AT FIELD FACILITY
Step 7
Evaluate Implementation
Airspace Design Team
After Action Report
Involve environmental specialists
Inform stakeholders

CHECKLIST

____ **1** **CHARACTERIZE PROBLEM**

What is the true nature and extent of the problem?

____ **2** **PERFORM INITIAL EVALUATION**

Identify and evaluate alternatives and make recommendations.

____ **3** **INITIATE AIRSPACE STUDY**

Establish airspace design team, write a charter, and develop a study plan.

____ **4** **CONDUCT AIRSPACE STUDY**

Alternatives, metrics, models, data ... and much more.

____ **5** **SUMMARIZE AND PRESENT RESULTS**

Convey the study results to the decisionmakers and the stakeholders.

____ **6** **PLAN IMPLEMENTATION AT FIELD FACILITY**

Carefully consider information exchange and transition issues.

____ **7** **EVALUATE IMPLEMENTATION**

Make sure the change accomplishes its intended purpose.

Outline for Handbook

1 Characterize Problem

Problems with airspace design or structure are often identified internally from within the Federal Aviation Administration (FAA) or by sources external to the FAA such as National Airspace System (NAS) users, airport authorities, or communities. In most cases, the FAA field facility that is affected by a problem or its solution will have primary responsibility for examining the issues. FAA Headquarters will probably be responsible for issues that involve multiple regions or national airspace. Characterization of the problem is crucial since it sets the stage for the subsequent phases of study. It is important to ensure that problem characterization does not repackage the original issue, but rather determines the true nature of the problem and extracts the root cause.

The approach for characterizing a problem should be tailored to fit the situation. The approach can be very simple, relying heavily on anecdotes and judgment, or it can be a sophisticated application of tools to analyze data. In all cases, some analysis will be required along the lines of the basic principals of the scientific method.

Problem characterization can be an iterative process, with the possibility that any new investigation could open additional questions about the nature and extent of the problem. Step 1 can also be interactive with Step 2, Initial Evaluation.

See the Guidelines, Step 1, for a more detailed discussion of problem characterization.

2 Perform Initial Evaluation

Not all problems or issues identified with the use of the NAS need to be resolved through a change in the airspace structure. As described in Step 1, the characterization of some perceived problems shows that they are not problems at all. Many real problems can be resolved without resorting to changes in the airspace structure. As with all problems, NAS problems should be resolved in an expeditious manner with the least amount of effort and resources expended. Only when it is clearly indicated should changes to the airspace structure be considered. Initial evaluation is performed to develop various alternatives to solve the problems and to support (justify) necessary action.

The initial evaluation process usually begins at the field facility where the problem is perceived to exist, or where the proposed operational change would have the greatest impact. The initial evaluation, and possibly the resolution, can sometimes be conducted by a small group of people, based on their expert judgment and knowledge of the circumstances.

See the Guidelines, Step 2, for a more detailed discussion of the initial evaluation process.

3 Initiate Airspace Study

If an airspace study is to be performed, then an airspace design team must be formed. The airspace design team is named by the cognizant regional airspace manager, or the lead organization for the airspace analysis. The airspace design team drafts the charter for the proposed study.

Charter development assists the airspace design team in determining if additional membership is needed, including outside stakeholders. The draft charter for the airspace study will be provided to FAA Headquarters for review and coordination.

The first task of the expanded airspace design team (which may now include stakeholder representatives, members from other regions, and perhaps a member from ATA-200 as well as other FAA Headquarters organizations), is to develop a comprehensive study plan. The scope of the study should generally correspond to the complexity of the proposed change, the number of facilities involved, and the potential impact of the proposed changes.

See the Guidelines, Step 3, for a more detailed discussion of how to initiate an airspace study.

4 Conduct Airspace Study

Every study should begin with a re-statement of the problem. This statement must be able to be clearly understood by all. The study team should be specific when documenting the issues. A specific statement of the primary issues is easier to understand, and makes it easier to plan subsequent analyses. A formal written statement of the problem is required. The most important ingredient to the successful airspace study is the appointment of a single, capable study manager to ensure all the study goals are met. If there are complicated and unique issues surrounding a study, the study team should take advantage of ATA-200 or the National Airspace Laboratory for assistance in the development of assumptions or alternatives, collection of data, or determination of metrics.

a. Revalidate Problem Statement

In Steps 1 and 2, the problem was characterized and then an initial evaluation performed. That initial evaluation sometimes leads to a recharacterization of the problem. Before starting the airspace study, the airspace design team must revalidate the problem statement to ensure that the nature and severity of the problem are well-understood, and that the issues associated with the problem have been identified and documented.

See the Guidelines, Step 4, for a more detailed discussion of why it is important to thoroughly revalidate the problem statement.

b. Select and Define Metrics

The up-front identification of the specific metrics the proposed changes will impact, and hopefully improve, is paramount. There is an interrelationship between the determination of metrics and the development of alternatives that must be adequately understood. A current baseline of those metrics must be documented in quantifiable terms so the amount of change due to the varying of parameters associated with each alternative solution under consideration can be precisely determined. These metrics are to be identified early and should be reexamined throughout the study to ensure their relevance and consistency to the long established National Airspace System goals of safety, flexibility, and efficiency.

See the Guidelines, Step 4b, for a more detailed discussion of how to select and define metrics.

c. Identify Alternatives

The airspace design team is responsible for developing a range of alternatives that will be formally studied to quantify the type and degree of improvements over the baseline system. The first step in generating alternatives is to brainstorm possible candidate improvements. The next step is to downselect from among the candidate improvements to arrive at the final set of alternatives for study.

See the Guidelines, Step 4c, for a more detailed discussion of identifying alternatives.

d. Determine Type of Analysis

An airspace study can be conducted in more than one way. Depending on the scope and complexity of the issue, the analysis could be very simple or very sophisticated. As a general rule, an issue should be studied using the minimum amount of effort. This could involve any or a combination of the following types of analysis: expert judgment, data reduction and statistical analysis, trend analysis, mathematical modeling, visualization tools, simulation modeling, and human-in-the-loop testing.

See the Guidelines, Step 4d, for a more detailed discussion of determining the type of analysis to be conducted.

e. Select Tool(s)

There are many factors to weigh when selecting the appropriate tool to be used in the study. None is more important than a tool's ability to generate the metrics defined in Step 4b. If the results of a candidate tool cannot be used to determine if the objectives of the study are being met, other tools need to be considered.

Three other aspects of tools are important to consider before making a final selection: the level of detail provided by the tool, the coverage, and the interdependence of domains.

See the Guidelines, Step 4e, for a more thorough discussion on the selection of tools.

f. Obtain Input Data

Data of many different types are typically required in airspace studies, depending on the type of analysis and the analysis tool selected. Different types of studies place different demands on the data collection effort. In some cases, it may not be possible to obtain the type and quality of data that corresponds to the study's metrics, alternatives, and tools. Adjustments could be made in any of these areas to balance data availability with the needs of the study.

See the Guidelines, Step 4f, for a more thorough discussion of how to obtain data.

g. Define Baseline and Alternative Scenarios

In an airspace study, a baseline scenario is developed to quantify the current state of the airspace and its traffic. The baseline also provides a point of reference from which the effects of airspace changes are evaluated. Various techniques, described in Step 4g of the guidelines, have been used in past studies to select baseline traffic and weather. The choice of technique to use for baselining depends on the objectives, assumptions, and alternatives of the study.

See the Guidelines, Step 4g, for more about defining the baseline and alternative scenarios.

h. Adapt, Calibrate, and Validate Model

The terms adaptation, calibration, and validation can mean a number of things when used in conjunction with airspace studies. For the purposes of this handbook, the following definitions are used. Adaptation refers to the data used during a study to represent the specific facilities, sites, or NAS resources being modeled. Calibration refers to adjustments made to tailor the behavior modeled by the tool to reflect new or changed NAS or aircraft capabilities. Validation refers to the steps taken to ensure that the model will provide reliable results for the specific study. It is important to validate the baseline and all the alternatives.

See the Guidelines, Step 4h, for a more detailed discussion of how to adapt, calibrate, and validate a model.

i. Make Production Runs

The analysis of alternatives entails exercising the model to predict how the study alternatives will perform under each of the study scenarios. Analyzing all possible combinations of alternatives and scenarios could require a significant number of model runs, which could be time-consuming and expensive to prepare, run, and review. In some cases, a subset of model runs can be selected to compare performance among the study alternatives and scenarios. Advance thinking about the production runs of airspace models will ensure that the results are meaningful and credible. Resources from ATA-200 or the National Airspace Laboratory should be consulted if necessary.

See the Guidelines, Step 4i, for a more detailed discussion of how to make production runs.

j. Analyze Model Output

Once the model runs are completed, the output results should be examined and comparisons made between the alternative results and the baseline results. The quantitative analysis of metrics often needs to be supplemented with the review of knowledgeable experts who can identify and assess the impacts of alternatives qualitatively. Some of the key consequences of airspace changes may not be captured well by models; for example, safety impacts are not easy to measure from simulation models, but could be evaluated by experts.

See the Guidelines, Step 4j, for a more detailed discussion of how to analyze model output.

k. Perform Sensitivity Analysis

Any large-scale study will require the airspace design team to make various assumptions while modeling the alternatives. Even if these assumptions have a strong basis in precedence and factual information, it is possible that one of more of them will turn out to be invalid by the end the study. Other assumptions are known to be inherently uncertain from the beginning because they are based on imperfect or incomplete information. This is clearly the case for all future events, such as the level and characteristics of the future traffic demand, since the future cannot be predicted precisely.

See the Guidelines, Step 4k, for more discussion about how to perform sensitivity analysis.

l. Conduct Human-in-the-Loop Testing and Evaluation

In some cases, it may be useful to supplement analyses using models with real-time evaluation by experienced pilots or air traffic controllers. Integrating the judgment and performance of a human with the analysis process contributes to the assessment of alternatives from a human factors point of view.

See the Guidelines, Step 4l, for more about human-in-the-loop testing.

5 Summarize and Present Results

The analyses performed, and the conclusions and recommendations derived from those analyses, should be documented in a formal study report. The formal study report should specify recommended airspace actions, sector realignments, route adjustments, and procedural changes necessary to implement the recommendations. An example outline for the study report is included in the guidelines. A formal study report is important because it conveys the key findings of the study to decisionmakers and stakeholders. A study report also documents the analysis and recommendations for historical reference.

See the Guidelines, Step 5, for a more detailed discussion of preparing the final study report.

6 Plan Implementation at Field Facility

Careful consideration of actions necessary to implement recommended airspace changes should be a part of the overall planning process. Although implementation issues ought to be considered throughout the study process, detailed implementation planning should begin immediately after approval for the airspace change. Careful implementation planning is necessary for airspace changes to avoid any interruption of air traffic services, to minimize any disruption of air traffic, and to communicate what airspace changes are to occur. Facilities implementing an airspace change should develop an Implementation Plan and a Transition Plan, which should together lay out an achievable schedule and describe the steps required to successfully coordinate and enact the change. Involvement of the users is imperative in developing the Implementation and Transition Plans, and in actually implementing the airspace changes.

See the Guidelines, Step 6, for a more detailed discussion of planning the implementation of airspace changes at the field facility.

7 Evaluate Implementation

Airspace changes should be evaluated after implementation to measure their success. Once in place, changes to the National Airspace System should be assessed to verify that the objectives specified in the Implementation Plan are achieved, to provide lessons learned concerning the process, and to ensure improved service to users of the National Airspace System.

See the Guidelines, Step 7, for a more detailed discussion of post-implementation evaluation of the impact of changes.